Chapter 1: Introduction

1.0 SUMMARY

This chapter is an introduction to *the 1998 Energy Efficiency Standards* (standards) for low-rise residential buildings. The parts of this chapter discuss:

- The legal, historical, comfort, economic and environmental reasons for having energy standards
- Which set of standards applies to buildings based upon their occupancy type and number of stories
- Basic approaches for building compliance under the standards
- Case studies illustrating how the standards are applied in a variety of permit situations
- The organization of this ***Residential Manual*** (Manual)
- Where to obtain additional help beyond the information contained here

A sample of the Certificate of Compliance (CF-1R), the form that summarizes compliance, is included in Appendix A and explained in Part 1.4.

CHAPTER OVERVIEW:

Applicable sections of California Code of Regulations Title 24, Part 1: 10-103.

1.1 REASONS FOR ENERGY STANDARDS

Legal Requirements

All new buildings in California must meet the standards contained in Title 24, Part 6 of the California Code of Regulations. All new construction must comply with the standards in effect on the date a building permit application is made (not issued).

Section 25402 of the Public Resources Code directs the California Energy Commission to:

> *"Prescribe, by regulation. . . building design and construction standards which increase the efficiency in the use of energy for new residential and new nonresidential buildings.*

"The standards shall be cost effective, when taken in their entirety, and when amortized over the economic life of the structure when compared with historical practice."

Section 25402 also states that:

The commission shall periodically update the standards and adopt any revision which, in its judgment, it deems necessary. Six months after the commission certifies an energy conservation manual . . . , no city, county, city and county, or state agency shall issue a permit for any building unless the building satisfies the standards prescribed by the commission . . .

Changes to the standards occur periodically to account for improvements in conservation technologies, changes in the cost of fuels and energy-conserving strategies, and improved capabilities in analyzing building energy performance. In addition, modifications are also made to further improve compliance and enforcement.

Benefits of Energy Conservation

Comfort

Compelling reasons exist for more efficient energy use in buildings. Comfort is an important reason. If a house is drafty, even a large, modern furnace will not keep it comfortable on a winter day. On a hot summer day no reasonable amount of air conditioning can maintain an appropriate sense of coolness in a room surrounded by clear glass windows without shading. The mechanical heating and cooling equipment are only part of the overall system that maintains a pleasantly comfortable indoor environment. The building shell (or envelope) is equally important and energy efficiency helps ensure that new homes maintain a reasonable level of comfort.

Economics

A second reason for energy efficiency is economics. For the homeowner, investing in building energy conservation helps to ensure that energy use in residences is affordable both now and into the future. Providers of financing recognize the impact of efficiency through energy efficient mortgages.

From a larger perspective, the less the state economy depends on depletable resources such as natural gas, coal and oil, the stronger and more stable it will remain in the face of increases in costs of those resources. Cost-effective investment in energy efficiency helps everyone.

Environment

A third benefit of energy efficiency is to the local environment. In many parts of the world, the need for more energy has led to oil spills, acid rain, smog and other forms of environmental pollution that have ruined the beauty people sought to enjoy. California is not immune to these problems, but they would be worse today without appliance standards, building standards and utility programs in effect since the late 1970s. The benefits of reducing environmental damage also include less destruction of natural habitats, which in turn helps protect animals, plants and the natural systems. By the year 2009, existing building standards will save more energy since their inception than seven enormous, multi-billion dollar coal plants could have produced—and without the air pollution accompanying those power plants.

Global Warming

Finally, the state faces a major uncertainty—global climate change or global warming. One of the contributors to global warming is a by-product from burning fossil fuel. Every time a fossil fuel is burned, no matter how cleanly, carbon dioxide is added to an atmosphere already containing 25 percent more than it did two centuries ago. Those extra gasses add an insulating layer to the earth that may lead to global climate change.

Most scientists agree that the effects of global warming will be significant. According to California Energy Commission (hereafter Energy Commission) research, most of the sectors of the state economy could face significant risk from climate change including water resources, agriculture, forests and the natural habitats of a number of indigenous plants and animals.

Many scientists recommend that actions be taken to reduce emissions of carbon dioxide and other greenhouse gasses. While adding *scrubbers* to power plants and catalytic converters to cars is a step in the right direction, those actions do not limit the carbon dioxide we emit into the atmosphere. Using energy efficiently is a far-reaching strategy that can make an important contribution to the reduction of greenhouse gasses. The National Academy of Sciences urged the whole country to follow California's lead on such efforts, saying that we should *make conservation and efficiency the chief element in energy policy*. Their first efficiency recommendation was simple: *Adopt nationwide energy efficient building codes*. Energy conservation will not only increase comfort levels and save homeowners money, it will also play a vital role in creating and maintaining a healthy environment.

1.2 PURPOSE AND ORGANIZATION OF THIS MANUAL

The purpose of this ***Manual*** is to explain clearly how to comply with and enforce the current standards for residential buildings. The Manual is written as both a reference source and an instructional guide, and it can be used by architects, builders, building owners, designers, energy consultants, enforcement agency personnel, engineers, mechanical contractors and others directly or indirectly involved in the compliance process.

An increased focus on building quality to improve comfort is scattered throughout the manual. Chapters 2 includes diagrams and guidelines for HVAC systems and ducts. Included in Chapter 2 are graphic representation of a well constructed duct using diagrams from Uniform Mechanical Code (UMC) and the Air Diffusion Council. Chapter 4 includes criteria for obtaining energy credit for ducts constructed more efficient than typical construction. Chapters 3 and 8 include diagrams and guidelines for building a better envelope, from Energy Efficiency Build America (a program sponsored by the federal Department of Energy).

The Manual is organized into chapters, each of which covers an important topic, or set of topics, regarding energy compliance and energy conservation in residential buildings. There are also several appendices including an extensive glossary.

Using the following icons, this Manual is organized, where appropriate, to:


Energy Code

(1) Present the relevant language (in italics) from the 1998 *Energy Efficiency Standards;*

(2) provide explanations or other direction to the:


Compliance/ Plan Check

(a) energy consultant and plan checker,


Construction

(b) the builder, and


Inspection

(c) the inspector

followed by:


Examples

(3) Examples and newsletter excerpts.

Scattered throughout are also:


Introduction

General information and concepts;

Useful Information

Information about how products or materials use and conserve energy; and

Quality Construction

Tools for improving the quality of construction to increase comfort and potentially reduce liability.

As a result of this new format, that should make it easier to use the manual as a reference, there is some duplication. For example, when information applies to both the builder and the inspector it will appear in both places.

Refer to Parts 1.3 and 1.4 to learn which steps to take and which information is relevant in a variety of compliance and enforcement situations.

Chapter 1, this ***Introduction***, serves as an overview of the standards. It explains how the standards apply to various building occupancies and highlights key aspects of compliance.

Chapter 2 discusses the ***Mandatory Measures*** called out in the standards relating to insulation levels, infiltration controls, HVAC and plumbing systems, lighting and appliance features.

Chapter 3 presents a detailed explanation of how to comply using the ***Prescriptive*** *(Alternative Component)* ***Packages***; a description of each package; an example of package compliance documentation; and a listing of the prescriptive package requirements for all 16 climate zones.

Chapter 4 details the compliance process using newly approved ***Quality Construction Options***, including high quality, efficient ducts and reduced building envelope infiltration. These compliance options are available through the performance (computer) compliance approach subject to installer certification and field verification and diagnostic testing by a certified HERS Rater.

Chapter 5 details the compliance process using approved ***Computer Methods***; outlines computer modeling guidelines and restricted inputs; and illustrates computer compliance documentation.

Chapter 6 covers ***Water Heating*** energy use, calculations and compliance documentation. It includes required water heating forms and worksheets.

Chapter 7 explains ***Additions and Alterations***, including compliance of additions with the prescriptive and the performance approaches.

Chapter 8 illustrates several ***Special Compliance Topics***: Multi-family buildings, mixed occupancy buildings, subdivision master plans, wood heat, log homes, solar energy systems, zonal control, hydronic space heating and radiant barriers.

The ***Appendices*** contain general reference tables, charts and lists relating to the implementation of the standards, including California Design Location Data and Climate Zone Descriptions. Appendix G, Glossary and Explanation of Key Terms, is an extensive source that explains compliance terminology applicable to all chapters.

The ***Index*** includes all applicable terms used in explaining residential building energy conservation, the low-rise Residential Standards and related compliance calculations.

1.3 CURRENT STANDARDS: ALL OCCUPANCIES

Changes for 1998 Residential Standards

Thermal Mass

Thermal mass is no longer required for compliance with prescriptive package D (Package E was eliminated because the only difference between the two was the thermal mass requirement). Homes designed for passive solar can use Package A or computer compliance to account for the benefits of a significant amount of thermal mass.

Water Heating

An R-12 water heater insulation blanket is mandatory for water heaters with an energy factor that is below 0.58. No compliance credit is given for water heater insulation. Compliance with the water heating budget is achieved with a non-recirculating, storage gas water heater, with a 0.53 energy factor.

Fenestration

All manufactured products must have a label with the U-value and Solar Heat Gain Coefficient (SHGC). All references to shading are now in terms of SHGC instead of Shading Coefficient (SC).

Only field-fabricated fenestration does not need to be labeled. The term field-fabricated replaces site-built, and refers to products where the frame is made from materials not previously cut or formed with the intention of being used for a fenestration product. Field fabricated does not include site assembled frame components that were manufactured elsewhere with the intention of being assembled on site (such as knocked down products, sunspace kits and curtainwalls).

Shading

In prescriptive compliance, shading must be provided by a fenestration product with the required SHGC (e.g., low-e^2), an exterior shading device or an overhang. Interior shading devices cannot be used to show compliance with prescriptive SHGC requirements.

SHGC (instead of SC) are fixed at 0.68 for draperies, 0.47 for blinds and 0.47 for roller shades until December 31, 2001. Beginning January 1, 2002, roller shades cannot be used for compliance. These are the only acceptable values for interior shading devices.

Ducts

All pressure-sensitive tapes, mastics, aerosol sealants or other closure systems must meet applicable UL 181A and B requirements

Drawbands Used with Flexible Duct shall:

- be either stainless-steel worm-drive hose clamps or uv-resistant nylon duct ties.
- have a minimum tensile strength rating of 150 pounds.
- be tightened as recommended by the manufacturer with an adjustable tensioning tool.

Credit for tight ducts, verified through diagnostic testing, is allowed with a computer compliance approach.

Lighting

The general lighting in kitchens must provide sufficient light for basic kitchen tasks and provide a uniform pattern of illumination. A light in a corner of the kitchen, whether efficient or not, will no longer meet the requirement.

The control for the general lighting in kitchens must be on a readily accessible switch at one of the entrances to the kitchen. This eliminates the need for determining what is the most accessible switch. Readily accessible means that it can be reached quickly without removing obstacles.

The bathroom lighting requirements were changed to require a high efficacy light source in each room with a shower or bathtub (no reference to water closet).

An alternative to the bathroom lighting is to install *both* of the following:

- A high efficacy lamp in a utility room, laundry room or garage; and
- All luminaires permanently mounted to the exterior of the residence for outdoor lighting must either have high efficacy lamps or be equipped with a motion sensor.

Raised Floor Insulation

R-8 insulation for concrete raised floor (e.g., apartments with underground parking) is no longer a mandatory requirement. Prescriptive Package D requires R-8 in climate zones 1, 2, 11, 13, 14 and 16, R-4 is required in zones 12 and 15, no concrete raised floor insulation is required in zones 3-10.

Space Conditioning

Prescriptive compliance with Package D can be achieved with any type of space heating, such as a wall furnace or space cooling system that complies with applicable appliance efficiency requirements. A setback thermostat is required.

Alterations

When space conditioning or water heating equipment is changed, it is limited to natural gas, liquefied petroleum gas or the existing fuel type. This prevents changeouts to less efficient fuel sources.

A new computer compliance provision for existing-plus-alteration allows trade-offs in alterations. This provision is primarily for an applicant who: (1) cannot or does not want to meet the 0.75 U-value for windows, or (2) wants to change from gas or LP to electric heating or water heating.

History of the Standards

The OPEC oil embargo of 1973 brought about an awareness of the need for an effective state energy conservation policy. The Legislature created the Energy Commission in 1974 to deal with energy-related problems, and it mandated that the Energy Commission adopt conservation standards for new buildings. The Energy Commission first adopted such standards in 1977.

The *First Generation* standards for nonresidential and residential buildings took effect in 1978. *First Generation* standards remained in effect for all nonresidential occupancies until January 1987, when a new set of *Second Generation* standards adopted in December of 1983 and January of 1984 became mandatory for office occupancies. *Second Generation* standards for retail and wholesale occupancies took effect in July 1988, when lighting requirements switched to the *Second Generation* format for all nonresidential occupancies.

Envelope and Heating, Ventilating and Air Conditioning (HVAC) compliance requirements for nonresidential occupancies, except office and retail/wholesale, remained the same from 1978 until the 1992 nonresidential standards took effect. However, permit applicants had the option of showing compliance on *First Generation* occupancies using a *Second Generation* compliance method from July 1988 until July 1992.

Second Generation Residential Standards took effect for single family dwellings in June 1983, and took effect for multi-family buildings in January 1984. Those standards included a Point System, and for the first time allowed the use of approved computer methods to demonstrate compliance. Additional legislation (AB 163) allowed the permit applicant to use a computer method to generate a *custom energy budget* based on the features prescribed in the Alternative Component Packages D (slab floor) or E (raised floor).

Revised *Second Generation* Residential Standards for low-rise residential occupancies took effect in July 1988. The Energy Commission provided a revised Point System with greater flexibility and accuracy. For computer compliance methods, the Energy Commission specified required capabilities including an automatic custom budget generator based on a standard design with the prescriptive features of Alternative Component Packages D or E. In addition, the computer methods were required to print out standardized forms.

High-rise residential and hotel/motel occupancies were covered under the 1978 *First Generation* Residential Standards until July 1992, when they come under the Nonresidential Standards. A relatively small set of revisions constituted the changes for the 1995 standards focusing on compliance and implementation issues rather than developing new standards. The 1998 revisions again focused on compliance and implementation issues.

Table 1-1 summarizes the Standards in effect since 1978, and lists the name of the compliance manual used in conjunction with that set of Standards.

Which Standards Apply?

The current standards (1998 Edition) generally apply to all *Uniform Building Code (UBC)* occupancies of Group A, B, E, F, H, M, R and S buildings that are *mechanically heated or mechanically cooled* resulting in *directly* or *indirectly conditioned space*. Nonresidential buildings that have space conditioning, but do not meet the criteria of a directly or indirectly conditioned building, must comply with the lighting requirements only. Group I or U occupancies are exempt from the standards. The exempt occupancies include buildings such as hospitals, prisons and residential garages.

Two different sets of standards apply to the UBC occupancies mentioned above, with each type pertaining to specific occupancy categories.

Nonresidential Standards

Current Nonresidential Standards have an effective date of July 1, 1999. These standards cover all nonresidential occupancies (Group A, B, E, F, H, M or S), as well as high-rise residential (Groups R-1 and R-2 with four or more habitable stories), and all hotel and motel occupancies. (The standards define a habitable story as one that contains space in which humans may live or work in reasonable comfort, and that has at least 50 percent of its volume above grade.) These buildings include:

- Offices
- Retail and wholesale stores
- Grocery stores
- Restaurants
- Assembly and conference areas
- Industrial work buildings
- Commercial or industrial storage
- Schools and churches
- Theaters
- Hotels and motels
- Apartment and multi-family buildings, and long-term care facilities (group R-2), with four or more habitable stories

Applicable compliance manual: *Nonresidential Manual for Compliance with the Energy Efficiency Standards*, P400-98-005 (July 1999).

Residential Standards

The 1998 Residential Standards have an effective date of July 1, 1999. These standards cover all low-rise residential occupancies including:

- All single family dwellings of any number of stories (Group R-3)
- All duplex (two-dwelling) buildings of any number of stories (Group R-3)
- All multi-family buildings with three or fewer habitable stories (Groups R-1 and R-2)
- Additions and alterations to all of the above buildings

NOTE:

All hotels and motels comply with the nonresidential standards.

Applicable compliance manual: This *Residential Manual for Compliance with the Energy Efficiency Standards*, P400-98-002 (July 1999).

Copies of the compliance manuals and other relevant publications may be obtained from the Energy Commission (see Part 1.6).

Table 1-1: History of the Standards

Effective Date	Set of Standards	Compliance Manual
March 1978	First Generation Residential included Hotels & High-rise)	*Energy Conservation Design Manual for New Residential Buildings* (2/78)
March 1978	First Generation Nonresidential	*Energy Conservation Manual for New Nonresidential Buildings* (10/77)
June 1983 (single-family), January 1984 (multi-family)	Second Generation Residential (excluded Hotels & High-rise)	*Energy Conservation Manual for New Residential Buildings* (Fall, 1984)
January 1987	Second Generation Nonresidential (Only Office)	*Energy Efficiency Manual, Designing for Compliance* (12/86)
July 1988	Second Generation Nonresidential (Office and Retail/Wholesale)	*Energy Efficiency Manual, Designing for Compliance* (9/88)
July 1988	Second Generation Residential (excluded Hotels & High-rise)	*Energy Conservation Manual for New Residential Buildings* (7/88)
July 1992	Nonresidential Standards (includes Hotels & High-rise Residential)	*Nonresidential Manual for Compliance with Energy Efficiency Standards* (7/92)
July 1992	Residential Standards (excludes Hotels & High-rise)	*Residential Manual for Compliance with Energy Efficiency Standards* (7/92)
July 1995	Nonresidential Standards (includes Hotels and High-rise Residential)	*Nonresidential Manual for Compliance with Energy Efficiency Standards* (7/95)
July 1995	Residential Standards (excludes Hotels & High-rise)	*Residential Manual for Compliance with Energy Efficiency Standards* (7/95)

NOTE: The *Uniform Building Code* defines a "guest room" as "any room or rooms used or intended to be used by a guest for sleeping purposes. *Every 100 square feet of superficial floor area in a dormitory shall be considered to be a guest room*" (italics added). Therefore, congregate residences, or any building with dormitory-style sleeping quarters, with six or more "guest rooms" is considered a hotel/motel for purposes of standards compliance (Section 101(b)). Hotels/motels, regardless of the number of stories, comply with the requirements found in the *Nonresidential Manual*.

When is a historical building exempt from the Energy Efficiency Standards (Title 24, Part 6)? Are additions to historical buildings also exempt?

A building is exempt from Part 6 when it is a "qualified historical building." This term is defined in Section 8-302 of Title 24, Part 8 as a "structure or collection of structures, and their associated sites, deemed of importance to the history, architecture, or culture of an area by an appropriate local, state or federal governmental jurisdiction. This shall include

designated structures on official existing or future national, state or local historical registers or official inventories, such as the National Register of Historic Places, State Historical Landmarks, State Points of Historical Interest, and officially adopted city or county registers or inventories of historical or architecturally significant sites, places or landmarks."

"Additions which are structurally separated" from the historical building are not exempt from the *Energy Efficiency Standards* and must comply with current building codes (*Historical Building Code*, Title 24, Part 8, Section 8-504).

Do the standards in Title 24, Part 6, apply to an addition to a mobile home?

No. Title 25 requirements, not Title 24, govern mobile homes, including additions to the unit. Jurisdiction in a mobile home park comes under the authority of Housing and Community Development. Jurisdiction of a mobile home on private property may come under the authority of the local building department.

Parts 1 and 6 of Title 24

References to Part 6 of Title 24 mean the Energy Efficiency Standards, also called the Energy Code. References to Part 1 of Title 24 mean the Administrative Regulations, of which Sections 10-101 through 10-112 pertain to Part 6. The Administrative Regulations contain information about the documentation requirements, procedural information and other administrative requirements.

1.4 RESIDENTIAL STANDARDS

To comply with the low-rise Residential Standards, a building must be shown to meet two basic requirements:

- Installation of several *mandatory measures* representing minimum conservation features and devices; and
- Demonstration that the building's predicted annual energy use meets the designated *energy budget* for space heating and cooling, and for water heating.

Mandatory Measures

Minimum ceiling, wall and raised floor insulation levels; minimum HVAC (heating, ventilating and air conditioning) and water heating equipment efficiencies, explained in Appendix G, the Glossary, are required features that apply to all low-rise residential buildings even if those features are not sufficient to show that a specific building meets the energy budget.

For example, R-13 insulation in wood frame walls is a mandatory measure. However, a building may be designed with R-19 walls in order to meet the energy budget. In that case, the R-19 supersedes the R-13 minimum requirement, and the R-19 must be installed for the building to comply. The same holds true for the other mandatory minimum insulation levels and equipment efficiencies (see Chapter 2, Part 2.1).

NOTE:

All low-rise residential buildings must have the mandatory measures installed. Compliance with the energy budget may not be required. Exceptions to the requirement of meeting the energy budget include:

(a) Seasonally occupied agricultural housing limited by state or federal agency contract to occupancy not more than 180 days in any calendar year.

(b) Low-rise residential buildings that use no energy obtained from a depletable source for either lighting or water heating and obtain heat from wood heating or other non-mechanical system.

California Climate Zones

Since energy use depends partly upon weather conditions which differ throughout the state, the Energy Commission has established 16 climate zones representing distinct climates within California (see Figure 1-1). These 16 climate zones are used with both the low-rise Residential and the Nonresidential Standards.

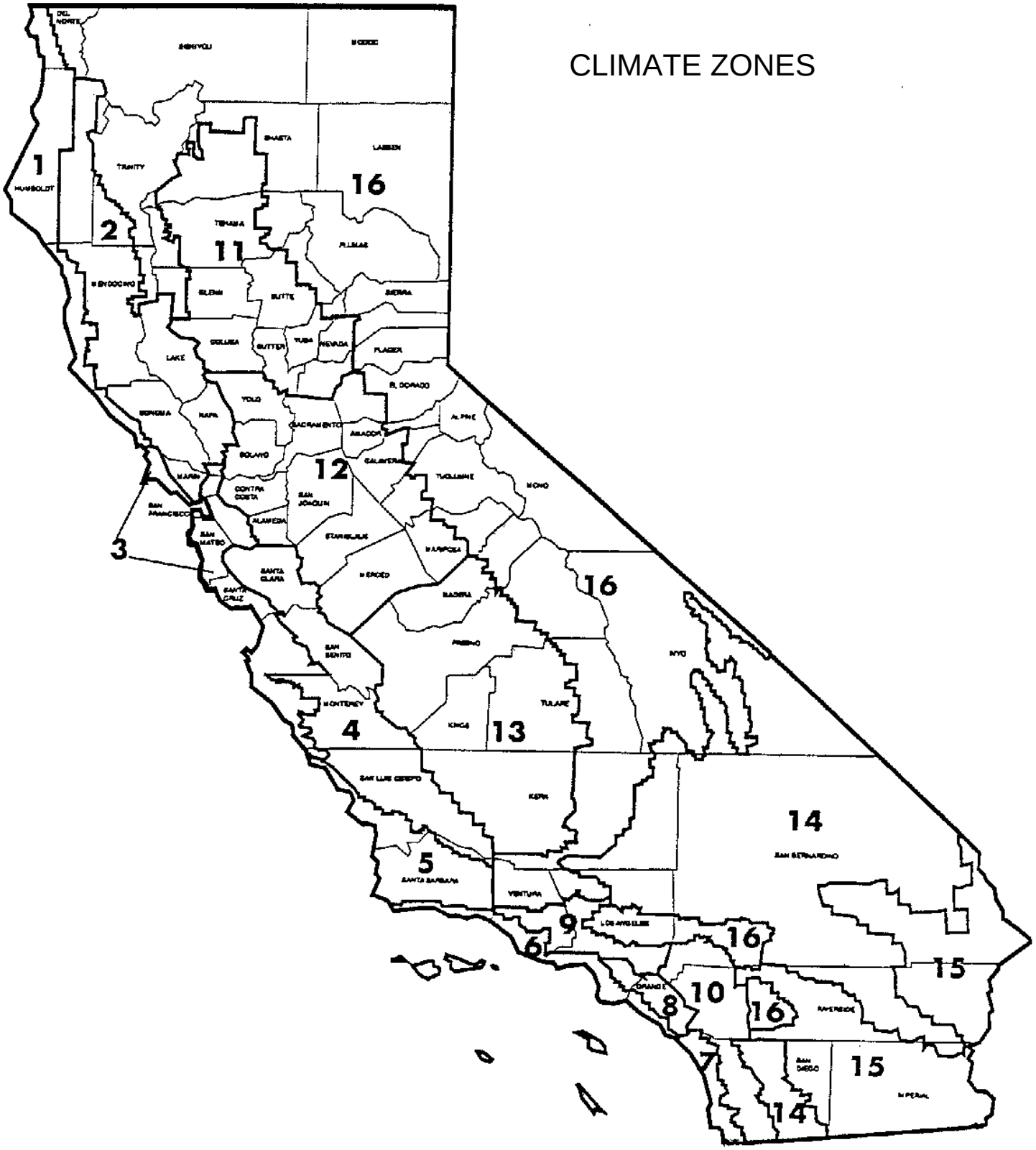

Figure 1-1: California Climate Zones

Detailed climate zone boundary descriptions and lists of locations within each zone are available in the Energy Commission publication *California Climate Zone Descriptions for New Buildings, July 1995*, (P400-95-041) an abridged version of which is contained in Appendix D.

NOTE:

Cities may occasionally straddle two climate zones. In these instances, the exact building location and correct climate zone should be verified before any calculations are performed.

If a single building development is split by a climate zone boundary line, it must be designed to the requirements of the climate zone in which 50 percent or more of the dwelling units are contained (see also Chapter 7).

Compliance With an Energy Budget

Two general options demonstrate that a residential building meets the energy budget defined in the standards:

- ***Prescriptive Packages*** *("Alternative Component Packages").* The simplest approach in which each individual component of the proposed building must meet a prescribed minimum energy requirement.

- ***Performance Methods*** *("Alternative Calculation Methods")*. Computer or hand-calculated performance methods provide the most flexibility and accuracy in calculating energy use. The most detailed accounting of energy *trade-offs* between measures is possible with the computer programs.

With any of these compliance paths, mandatory measures must be installed. Where superseded by a more stringent requirement to achieve compliance with the energy budget or prescriptive package, the more stringent feature becomes mandatory.

Prescriptive Packages

The standards provide a prescriptive approach to compliance using an *alternative component package* or *prescriptive package* of building conservation features. This approach is the least flexible yet simplest compliance path. It is simple because an applicant need only show that a building meets each minimum or maximum level prescribed in the set of requirements contained in a package; few calculations, if any, are needed to demonstrate compliance.

Four prescriptive packages are designated by the letters A, B, C or D for each climate zone. Buildings constructed according to any of the packages are deemed to meet the energy budget. There is no flexibility within any given package: *Every single feature* must be met in order for the building to comply. The only flexibility is in the selection of which package to choose, each package representing a different combination of building conservation features (see Chapter 3, Part 3.4).

Compliance documentation to be submitted with this approach:

- *CF-1R , Certificate of Compliance (required)*
- *MF-1R, Mandatory Measures Checklist (required)*
- *Form 3R, Construction Assembly U-Value (if applicable)*
- *Form 3RM, Masonry Wall Assembly (if applicable)*
- *Form CF-4R, Field Verification and Diagnostic Testing (if applicable)*
- *Form S, Solar Heat Gain Coefficient Worksheet (if applicable)*
- *Water Heating Calculations (if applicable)*

Two additional forms, the Installation Certificate (CF-6R) and the Insulation Certificate (IC-1) will be required to be provided during construction for the building inspection.

Refer to Chapter 3 for a full discussion of compliance with a prescriptive package. Refer to Chapter 7 for details on how the prescriptive approach is used with additions.

Performance Methods

Energy Commission-approved *alternative calculation methods* (ACMs) or *computer method*s represent the most detailed and sophisticated performance approach to compliance. While calculating or *modeling* the energy performance of a building may require the most effort, this method provides the greatest flexibility to demonstrate compliance.

In using an approved computer method, the *energy budget* for space conditioning is first automatically established by the computer program for the particular building being analyzed. This budget is derived by the program modeling the *standard design*, a version of the building which assumes all the prescriptive Package D conservation features.

The result is an energy budget for space conditioning expressed in kBtu per square foot per year. The program also calculates the budget for water heating energy use in kBtu per dwelling unit (see Chapter 6). The water heating budget is translated into a kBtu per square foot per year value and automatically added to the space conditioning budget to yield the *combined energy budget*. ***To comply with the standards, the predicted combined "Energy Use" of the Proposed Design cannot exceed the combined "Energy Budget" of the Standard Design.***

Compliance documentation to be submitted with this approach includes:

- *CF-1R , Certificate of Compliance (required)*
- *MF-1R, Mandatory Measures Checklist (required)*
- *C-2R, Computer Method Summary (required)*
- *Form 3R, Construction Assembly U-Value (if applicable)*

The Installation Certificate (CF-6R) and Insulation Certificate (IC-1) are required during construction.

Refer to Chapter 5 for a detailed explanation of compliance using approved computer methods.

If features are used for compliance that require field verification and diagnostic testing a CF-4R, as detailed in Chapter 4, will also be required at the completion of construction.

How to Comply With the Standards

Energy Code

Documentation (Section 10-103(a)(2))

(B) Plans and specifications submitted with each application for a building permit shall show the characteristics of each feature, material, component, and manufactured device proposed to be installed in order to have the building meet the requirements of Part 6, and of any other feature, material, component, or manufactured device that Part 6 requires be indicated on the plans and specifications. If any characteristic is materially changed before final construction and installation, such that the building may no longer comply with Part 6, the building must be brought back into compliance, and so indicated on amended plans, specifications, and Certificate(s) of Compliance and shall be submitted to the enforcement agency. Such characteristics shall include the efficiency (or other characteristic regulated by Part 6) of each device.

(C) All documentation necessary to demonstrate compliance for the building, and of the sections of Part 6 with which the building is intended to comply shall be submitted with each application for a building permit. The forms used to demonstrate compliance shall be readily legible and of substantially similar format and informational order and content to the appropriate forms in the Residential or Nonresidential Manual, as defined in Part 6.

Compliance/
Plan Check

How to Comply with the Standards

Title 24, Part 6 contains the Energy Efficiency Standards that must be complied with, Part 1 contains administrative, documentation, and procedural requirements for complying with the standards.

To comply with the Residential Standards, the permit applicant follows these general steps:

- Verify that the low-rise Residential Standards apply and that the correct climate zone is used for the building location.

- Demonstrate that the building meets the standards with one of the two compliance options: prescriptive packages or approved performance method.

- Include all appropriate mandatory features and provisions applicable to the building design.

- Document and coordinate all calculations, plans and specifications. This includes completing a *Certificate of Compliance (CF-1R)* which must appear on the drawings. See below for additional information on the CF-1R. (Blank forms are in Appendix A.)

- Install all specified measures in the building. The person responsible for construction or the installer of equipment must either post the installation certificate (Form CF-6R) or keep it with the plans and make it available to the inspector. This form, or several forms that together contain all the required information, must identify and provide the relevant energy efficiency data for each HVAC system, water heater system, fenestration product, faucet and showerhead, and any other manufactured device regulated by the standards.

  In addition, an Insulation Certificate (IC-1) must also either be posted by the insulation installer in a conspicuous location or kept with the plans and made available to the inspector. See below for additional information about the CF-6R and IC-1 forms. (Blank forms are in Appendix A).

- With a new dwelling unit: Deliver a *California Guide to Home Comfort and Energy Savings* or an equivalent document (see below) to the building owner at the time of occupancy along with copies of the CF-1R, MF-1R, CF-6R and IC-1. See below for additional information about the *California Guide to Home Comfort and Energy Savings* (formerly the Home Energy Manual).

The enforcement agency may require the person with overall responsibility for the construction to provide any other reasonable information to determine that the building as constructed is consistent with approved plans and specifications and complies with Part 6. (See Figure 1-2)

Examples

How to Comply with the Standards

What is a CF-6R and why is it required?

The CF-6R is an installation certificate for manufactured devices regulated by the appliance standards (see Part 6 of Title 24, Section 111) and a certification of installer tests for duct efficiency and reduced envelope leakage credits. The certification must include a statement indicating that installed devices conform to appliance and building standards and to any additional requirements contained in the plans and specifications. The certificate must be signed by the person with overall responsibility for construction or the person(s) responsible for installing the certified devices and/or appliances. This certificate must either be posted adjacent to the building permit or made available to the inspector during construction.

Information required on the CF-6R such as manufacturer, model number and efficiency helps to ensure that installed devices conform to specifications on the CF-1R and meet or

exceed minimum efficiency requirements. It also serves to advise the home owner what devices were installed in their home.

Responsibility for Signing

Energy Code

Certificate of Compliance
Section 10-103(a)(1)

The Certificate(s) of Compliance described in Section 10-103 shall be signed by the person(s) responsible for the building design to certify conformance with Part 6. The signer(s) shall be eligible under Division 3 of the Business and Professions Code to sign such documents. If more than one person has responsibility for building design, each person may sign the document or documents applicable to that portion of the design for which the person is responsible. Alternatively, the person with chief responsibility for design may prepare and sign the document for the entire design.

Subject to the preceding paragraph, persons who prepare energy compliance documentation shall sign a statement that the documentation is accurate and complete.

Compliance/
Plan Check

Signatures on Certificates

Certificate of Compliance

The signature on the Certificate of Compliance of the "Designer" is the person who takes responsibility for the building design being in compliance with the standards. This person must have the authority given by the *Business and Professions Code* for the type of construction.

NOTE:

The documentation author is not subject to the limitations and restrictions of the *Business and Professions Code*. The documentation author's signature is to verify that the documentation is accurate and complete.

Section 5537(a) and 6737.1 of the *Business and Professions Code* specifically exclude the following building types from requiring a licensed architect and engineer to design the building:

"5537 [and 6737.1]. (a) This chapter does not prohibit any person from preparing plans, drawings, or specifications for any of the following:

"(1) Single-family dwellings of woodframe construction not more than two stories and basement in height.

"(2) Multiple dwellings containing no more than four dwelling units of woodframe construction not more than two stories and basement in height. However, this paragraph shall not be construed as allowing an unlicensed person to design multiple clusters of up to four dwelling units each to form apartment or condominium complexes where the total exceeds four units on any lawfully divided lot.

"(3) Garages or other structures appurtenant to buildings described under subdivision (a), of woodframe construction not more than two stories and basement in height.

"(4) Agricultural and ranch buildings of woodframe construction, unless the building official having jurisdiction deems that an undue risk to the public health, safety, or welfare is involved.

"(b) If any portion of any structure exempted by this section deviates from substantial compliance with conventional framing requirements for woodframe construction found in the most recent edition of Title 24 of the California Code of Regulations or tables of limitation for woodframe construction, as defined by the applicable building code duly adopted by the local jurisdiction or the state, the building official having jurisdiction shall require the preparation of plans, drawings, specifications, or calculations for that portion by, or under the responsible control of, a licensed architect or registered engineer. The documents for that portion shall bear the stamp and signature of the licensee who is responsible for their preparation. Substantial compliance

for purposes of this section is not intended to restrict the ability of the building officials to approve plans pursuant to existing law and is only intended to clarify the intent of Chapter 405 of the Statutes of 1985."

If the building type requires that a licensed individual take responsibility for design under the *Business and Professions Code*, then that individual signs as designer and lists his or her license number above the signature. When the building type does not require the signature of a licensed individual, another individual may take responsibility as designer.

When the CF-1R is submitted for a single building plan to be built in multiple orientations (see Chapter 7, Part 7.4), the signature requirements may be met in one of two ways at the option of the document author:

- Indicate *all* shading variations on *one* signed CF-1R form which must appear on the plans. Include all CF-1R and C-2R forms with the calculation submittal; *or*,

- A signed CF-1R form for *each* shading variation must appear on the plans. Include C-2R forms with the calculation submittal.

The person who signs as the designer certifies that he or she has either:

- Directly prepared and coordinated the compliance documents; *or*

- Delegated responsibility to an energy documentation author who has provided the compliance analysis and documentation under their direction.

The documentation author also signs the CF-1R to indicate their responsibility for the accuracy and completeness of the compliance documentation.

Field Verification and Diagnostic Testing Certificate

HERS Provider/Rater

When compliance documentation indicates field verification and diagnostic testing of specific energy efficiency improvements as a condition for those improvements to qualify for Title 24 compliance credit, an approved HERS provider and certified rater must be used to conduct the field verification and diagnostic testing.

The HERS rater providing the diagnostic testing and verification shall sign and date a *Certificate of Field Verification and Diagnostic Testing* (CF-4R) certifying that they have verified that the requirements for compliance credit have been met. The HERS rater shall provide this certificate to the builder and the HERS provider. Raters shall provide a separate *Certificate of Field Verification and Diagnostic Testing* for each house the rater determines has met the diagnostic requirements for compliance. The HERS rater shall not sign a *Certificate of Field Verification and Diagnostic Testing* for a house that does not have a CF-6R signed by the installer.

Installation and Insulation Certificates

The standards require that the CF-6R be signed by the installer of each device (heating, cooling, water heating/plumbing equipment, heating and cooling distribution systems, air infiltration reduction systems, and fenestration products) or alternatively, the person with chief responsibility for construction.

The insulation installer must sign the IC-1.

Persons signing these forms are verifying that the installed efficiencies meet or exceed those used for compliance with the standards as shown on the CF-1R.

Certificate of Compliance

Energy Code

Certificate of Compliance
(Section 10-103(a)(2))

(A) For all new buildings designated to allow a conditioned use of an occupancy group or type regulated by Part 6 the applicant shall file the appropriate Certificate(s) of Compliance on the plans. The

Certificate(s) shall indicate the features and performance specifications needed to comply with Part 6, and shall be approved by the local enforcement agency by stamp or authorized signature. The Certificate(s) of Compliance and supporting documentation shall be readily legible and of substantially similar format and informational order and content to the appropriate Certificate(s) of Compliance and supporting documentation in the appropriate Residential or Nonresidential Manual, as defined in Part 6.

Compliance/
Plan Check

Certificate of Compliance (CF-1R)

All building permit applicants *shall file a certificate of compliance* ***on the plans*** as required by Title 24, Part 1, Section 10-103(a)2A of the Code of Regulations.

The items listed in the CF-1R form represent a set of minimum energy performance specifications, including the results of the heating load calculation. While a performance method analysis may be used to show compliance on a particular combination of conservation measures, the building must be constructed to meet or exceed the performance level established by all of the features and specifications contained in the CF-1R.

The requirement that the certificate be *on the plans* may be met by placing a transparency of the CF-1R on the drawings, taping a CF-1R to the drawings or printing the CF-1R information directly on the drawings. Verify with the local enforcement agency which is acceptable.

A blank copy of the recommended CF-1R form is contained in Appendix A. The same information is submitted regardless of which compliance approach is used. Completed examples of the CF-1R form are contained in the compliance documentation parts of Chapters 3 and 4.

Mandatory Measures Checklist: Residential

Compliance/
Plan Check

Mandatory Measures Checklist (MF-1R)

The Mandatory Measures Checklist for Residential Buildings is provided as a convenient summary of the mandatory measures required for low-rise residential buildings.

The items listed on the MF-1R form represent must be installed at or above the efficiency levels specified. In some cases, a specific compliance approach have requirements that supercede and go beyond the mandatory measure requirement. For example, Package D requires R-30 ceiling insulation which is more than the mandatory measure minimum of R-19. While the performance approach allows the standards to be met with more flexibility, the mandatory measures must always be met or exceeded regardless of the compliance approach.

Installation and Insulation Certificates

Energy Code

Installation and Insulation Certificates (Section 10-103(a) (3) and (4))

(3) Installation Certificate.

(A) The person with overall responsibility for construction or the person or persons responsible for the installation of regulated manufactured devices shall post, or make available with the building permit(s) issued for the building, the installation certificate(s) for manufactured devices regulated by the appliance standards or Part 6. Such installation certificate(s) shall be made available to the enforcement agency for all appropriate inspections.

These certificates shall:

1. *Identify features required to verify compliance with the appliance standards and Part 6.*

2. *Include a statement indicating that the installed devices conform to the appliance standards and Part 6 and the requirements for such devices given in the plans and specifications approved by the local enforcement agency.*

3. *State the number of the building permit under which the construction or installation was performed.*

4. *Be signed by the individual eligible under Division 3 of the Business and Professions Code to accept responsibility for construction, or their authorized representative. If more than one person has responsibility for building construction, each person may prepare and sign the part of the document applicable to the portion of construction for which they are responsible; alternatively, the person with chief responsibility for construction may prepare and sign the document for the entire construction).*

(B) The enforcement agency may require the person with overall responsibility for the construction to provide any other reasonable information to determine that the building as nconstructed is consistent with approved plans and specifications and complies with Part 6.

(C) If construction on any portion of the building subject to Part 6 will be impossible to inspect because of subsequent construction, the enforcement agency may require the installation certificate(s) to be posted upon completion of that portion.

(4) Insulation Certificate.

After installing wall, ceiling, or floor insulation, the installer shall make available to the enforcement agency or post in a conspicuous location in the building a certificate signed by the installer stating that the installation is consistent with the plans and specifications described in Section 10-103(a)2.A and for which the building permit was issued and conforms with the requirements of Part 6. The certificate shall also state the manufacturer's name and material identification, the installed R-value, and (in applications of loose fill insulation) the minimum installed weight per square foot consistent with the manufacturer's labeled installed design density for the desired R-value.

Construction

Installation and Insulation Certificates (CF-6R and IC-1)

The Installation Certificate (CF-6R) and Insulation Certificate (IC-1) are required to be posted at the job site or made available with the building permit during the construction phase of the project. The CF-6R is used to document all equipment and fenestration products installed in the building and installer test results for duct efficiency and reduced infiltration measures. The installer is responsible for verifying and complying with the efficiencies used to achieve compliance, as indicated on the CF-1R. These efficiencies (such as AFUE or HSPF for heating equipment, SEER for cooling equipment, energy factor for water heating, and U-value for fenestration products) must meet or exceed each value shown on the CF-1R. This means that the AFUE, HSPF, SEER or EF must be greater than or equal to the CF-1R value and the U-value and SHGC must be equal to or less than the CF-1R value.

NOTE: In a cold climate where heating loads significantly dominate cooling loads, a lower SHGC may be worse for the overall energy efficient operation of the home.

The IC-1 must be posted at the job site in a conspicuous location (e.g., in the garage) or

kept with the building permit and made available to the enforcement agency. The IC-1 must document the actual value of the installed insulation.

Both forms must be provided to the building owner at occupancy.

Examples

Installation and Insulation Certificates (CF-6R and IC-1)

What are the plan checking/field inspection requirements related to the CF-6R?

The CF-6R (Installation Certificate) is not required to be submitted with other compliance documentation at the time of permit application, but rather is posted or made available for field inspection. A field inspector will want to check the equipment installed against what is listed on the CF-6R *and* compare the CF-6R and CF-1R for consistent equipment characteristics.

For a performance approach that relies on duct efficiency improvements or reduced envelope leakage, the field inspector should check the *Special Features and Modeling Assumptions* and *HERS Required Verification* listings on the CF-1R for required installer tests for reduced duct leakage or building pressurization and verify that these tests were performed and documented on the Installation Certificate CF-6R.

California Code of Regulations Section 10-103(a)(3)(B) allows the enforcement agency to request additional information to determine that the building is constructed consistent with approved plans and specifications. When equipment efficiencies above the minimum requirements are shown on the CF-1R (e.g., 12 SEER cooling equipment; 0.63 energy factor water heater), the building department should have procedures in place to verify efficiency. Requiring proof of efficiency from the installer, such as a copy of the appropriate page from a directory of certified equipment, is one possibility. Another possibility is to require that the applicant send a duplicate of the CF-6R through plan check for verification.

What happens to the CF-6R after the final inspection?

California Code of Regulations Section 10-103(b) requires that the builder provide to the "building owner, manager, and the *original occupants* the appropriate Certificate(s) of Compliance and a list of the features, materials, components, and mechanical devices installed in the building, and instructions on how to use them efficiently" (italics added). At a minimum, the information on the CF-6R and CF-1R must be provided to the original building occupants as well as operating and maintenance information such as is contained in the *California Guide to Home Comfort and Energy Savings* (see below).

California Guide to Home Comfort and Energy Savings

Energy Code

Operating and Maintenance Information (Section 10-103(b)

Operating and Maintenance Information to be Provided by Builder.

(1) Operating Information. The builder shall provide the building owner at occupancy the appropriate Certificate(s) of Compliance and a list of the features, materials, components, and mechanical devices installed in the building and instructions on how to operate them efficiently. The instructions shall be consistent with specifications set forth by the Executive Director.

For residential buildings, such information shall, at a minimum, include information indicated on forms Certificate of Compliance (CF-1R), Mandatory Measures (MF-1R), Installation Certificate (CF-6R), Insulation Certificate (IC-1), and a manual which provides all information specified in this Section 10-103(b). The California Guide to Home Comfort and Energy Savings (P400-99-031) may be used to

meet the requirement for providing this manual.

For dwelling units, buildings or tenant spaces which are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for operating the feature, material, component or mechanical device installed in the building.

(2) *Maintenance Information. The builder shall provide to the building owner at occupancy maintenance information for all features, materials, components, and manufactured devices that require routine maintenance for efficient operation. Required routine maintenance actions shall be clearly stated and incorporated on a readily accessible label. The label may be limited to identifying, by title and/or publication number, the operation and maintenance manual for that particular model and type of feature, material, component, or manufactured device.*

For dwelling units, buildings or tenant spaces which are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for maintaining the feature, material, component, or mechanical device installed in the building.

Construction

California Guide to Home Comfort and Energy Savings and Forms to First Occupant

The owner of the residence when it is first occupied must receive a *California Guide to Home Comfort and Energy Savings (or =)* and the following compliance forms (signed copies, where applicable) for their building:

- CF-1R
- MF-1R
- CF-6R
- IC-1

The Energy Commission has prepared a *California Guide to Home Comfort and Energy Savings* that provides information to the homeowner regarding energy saving features and energy efficient operation and maintenance of their home. This guide is the type of guide that must be provided to fulfill the requirements of the standards. The Energy Commission's California Guide to Home Comfort and Energy Savings may be used to meet these requirements or can be used as a sample for developing one.

- The *California Guide to Home Comfort and Energy Savings* (formerly the Home Energy Manual) is available from the Energy Commission's publication unit, as publication number P400-99-031.

In multi-family buildings or where central systems provide space conditioning or water heating, the information is provided to whoever is responsible for operating and maintaining the building or equipment.

Examples

California Guide to Home Comfort and Energy Savings and Forms to First Occupant

As a general contractor, when I have finished building a residence, is there a list of materials I am supposed to give to the building owner?

The "owner at occupancy" must receive a copy of the following completed forms for that dwelling unit:

- Certificate of Compliance (CF-1R)
- Mandatory Measures Checklist (MF-1R)
- Installation Certificate (CF-6R)
- Insulation Certificate (IC-1)

In addition, they must receive either:

- A manual which contains instructions for operating and maintaining the features of their building efficiently, or

- The *California Guide to Home Comfort and Energy Savings* published by the Energy Commission.

(*Administrative Regulations*, Section 10-103(b)(1)-(2)).

I build some multi-family buildings and have some questions about the information I must provide (as required by Administrative Regulations, Section 10-103). Specifically:

(1) If the building is a condominium, can I photocopy the same information for all units?

Photocopied information is acceptable. It must be obvious that the documentation applies to that dwelling unit—that is, the features installed must match the features shown on the Installation Certificate. If compliance documentation is for a "building," a photocopy of the compliance forms for that building must be provided. If individual compliance is shown for each unique dwelling unit, a photocopy of the documentation which applies to that dwelling unit must be provided.

(2) When the building is an apartment complex (not individually owned units), who gets the documentation?

The documentation and operating information is provided to whomever is responsible for *operating* the feature, equipment or device (typically the occupant). Maintenance information is provided to whomever is responsible for *maintaining* the feature, equipment or device. This is either the owner or a building manager. (Section 10-103(b)(1)-(2).)

(3) If an apartment is converted to condominiums, does each owner/ occupant receive copies of the documentation?

If, during construction, the building changes from an apartment to condominiums, each owner at occupancy would receive the documentation. If an existing apartment building changes to condominiums at a later date, the documentation requirements are triggered only by a building permit application requiring compliance with the *Energy Efficiency Standards*. (Changing occupancy does not trigger compliance with the standards.)

What is my responsibility with respect to the CF-6R (Installation Certificate) (a) as an inspector? and (b) as a builder?

The building inspector is responsible for checking the CF-6R at appropriate inspections to be sure it is filled out and signed for the completed work. Inspectors can verify that the installed features are "consistent with approved plans," as indicated on the Certificate of Compliance (CF-1R) form. Since the CF-6R may be posted at the job site or kept with the building permit, the inspector can request that this form be made available for each appropriate inspection. It is not advisable to wait until the final inspection to check the CF-6R. (Section 10-103(d)(2).)

The general contractor, or his/her agent (such as the installing contractor), takes responsibility for completing and signing the form for the work performed. (A homeowner acting as the general contractor for a project may sign the CF-6R.) The compliance statement for their signature indicates that the equipment or feature: is what was installed; is equivalent or more efficient than required by the approved plans (as indicated on the CF-1R); and meets any certification or performance requirements. (Section 10-103(a)(3)(A).)

Compliance and Enforcement Phases of the Building Process and the Roles of the Building Community

The goals set by any building standard are no better than the level of cooperation and communication among the parties involved in the building process. These parties may include some or all of the following: architect or designer, builder/developer, purchasing agent, general contractor, subcontractor/installer, energy consultant, plan checker, inspector, realtor and owner/first occupant. To help resolve potential energy compliance issues, the standards specify detailed reporting requirements that are intended to provide design, construction, and enforcement parties with needed information to complete the building process and insure the energy features are installed. The above parties are accountable for insuring the building's energy features are installed in their phase of responsibility.

Design

This phase generally sets the stage for the type and style of building to be constructed. In addition to issues concerning zoning, lot orientation and infrastructure layout, the building's overall design and energy features are conveyed to working drawings of the building for construction. Parties associated with this phase must insure the energy features meet compliance with the standards and that these features are detailed on the construction plans.

Plan Check

Local building departments check plans for conformance to building standards. This includes health and safety requirements, such as fire and structural, along with energy requirements. Vague and/or missing details on the construction plans must be changed or clarified by parties involved in the design phase of the building process.

Construction

Upon receiving a building permit from the local building department, parties associated with this phase construct the building according to the approved construction plans. It is not unusual for changes to be made "in the field". Field changes which may result in non-compliance require building department approval of revised plans and energy compliance documentation demonstrating that the building is still in compliance.

Site Inspection

Local building departments, or their representatives, inspect all new buildings to insure conformance to building standards. Field construction changes and non complying energy features require parties associated with previous phases to repeat and revise their original efforts.

Occupancy

The standards require that the building owner at occupancy receive information indicated on forms:

- Certificate of Compliance (CF-1R)
- Mandatory Measures Checklist (MF-1R)
- Installation Certificate (CF-1R)
- Insulation Certificate (IC-1)

They must also receive either:

- A manual which contains instructions for operating and maintaining the features of their building efficiently, or
- The *California Guide to Home Comfort and Energy Savings* (P400-99-031).

For individually owned units in a multi-family building the documentation is provided to the owner of the dwelling unit or to the individual(s) responsible for operating the feature, equipment or device. The maintenance information is provided to whomever is responsible for maintaining the feature, equipment or device. Information must be for the appropriate dwelling unit or building (photocopies are acceptable).

1.5 CODE DECISIONS: CASE STUDIES

The first step in any project is to establish which standards apply and which compliance requirements must be met. Once that is done, compliance options can be considered and appropriate documentation prepared (or, in

the case of enforcement, forms reviewed and data verified).

Be sure that basic code decisions are correct; otherwise a considerable waste of effort may be expended attempting to meet the standards using an incorrect compliance approach. If in doubt, verify fundamental assumptions about the applicability of the standards for a specific project with the local enforcement agency before performing calculations to demonstrate compliance. The Energy Commission Energy Hotline is also available for assistance as explained in Part 1.6.

The following examples present several residential building scenarios and explain each in the context of which standards, if any, apply.

Example 1-1: Sunspace Addition

A sunspace addition is designed with no mechanical heating or cooling and a glass sliding door separating it from all existing conditioned space. The standards do not apply if the space is *unconditioned* (see Appendix G Glossary). This is the case if:

- The new space is not provided with heating or cooling (or supply ducts);
- The new space can be closed off from the existing house with weather-stripped doors; and,
- The addition is not *indirectly conditioned space* (see Appendix G Glossary).

Example 1-2: High-rise Mixed Occupancy

Three stories of residential dwelling units are planned over a first story that includes retail and restaurant occupancies. The residential apartments must comply with the Nonresidential (High-rise Residential) Standards since the structure contains four habitable stories and, as a whole structure, is a high-rise building. See Mixed Occupancy Buildings in Chapter 8, Part 8.2 to determine whether all four stories can be treated as the dominant occupancy.

Example 1-3: Four-Story Single Family Dwelling

A four-story single family townhouse is built. As a group R-3 occupancy, the Residential Standards apply. The building is not an apartment house (which, according to the UBC, must be at least three dwelling units).

Example 1-4: One Dwelling in Mixed Occupancy

A 1200 ft^2 manager's residence is being constructed as part of a new conditioned warehouse building with 14,000 ft^2. The whole building can comply with the Nonresidential Standards, and the residential unit is not required to comply separately since it is a subordinate occupancy containing less than 10 percent of the total conditioned floor area (see Chapter 8, Part 8.2). However, the residential dwelling unit must meet all low-rise residential mandatory measures (see Chapter 2).

Example 1-5: One Dwelling Addition

Assume the same scenario as in Example 1-4, except that the dwelling unit is new and the remainder of the building is existing. Since 100 percent of the addition being permitted is a low-rise residential occupancy, compliance under the Residential Standards is required (see Chapter 7).

Example 1-6: Alteration

An existing duplex is remodeled without increasing the amount of conditioned space. Even though no new conditioned space is being created, the remodel must comply with applicable mandatory measures, as explained in Chapter 7, Part 7.5 (also see Chapter 2).

Example 1-7: Alteration

An existing house is remodeled without increasing conditioned space. New windows are replacing old ones, and a new window is being added. Several exterior walls are being opened up in order to install new wiring. The house must meet the compliance requirements explained in Chapter 7, Part 7.5 (see *Example 7-3*) (new window 0.75 maximum U-value), as well as the mandatory measures applicable to the windows and wall insulation described in Chapter 2.

Example 1-8: Small Addition

A 95 ft^2 family room is being added to an existing 2800 ft^2 house. The addition alone must comply with the Residential Standards (see Chapter 6, Part 6.2) or the existing-plus-addition must comply as explained in Chapter 7, Part 7.3. If the prescriptive compliance approach is used for the addition alone, special prescriptive requirements apply (see Chapter 7, Table 7-1).

Example 1-9: Relocated Building

A residence is being moved to a different location. Since this is existing conditioned space, the requirements applicable to alterations would apply to any alterations being made (Chapter 7, Part 7.5). The building does not need to show compliance with the current energy standards applicable to new buildings or additions.

Example 1-10: Change of Occupancy

A previously conditioned retail space is remodeled to become a residential dwelling. The residential dwelling is treated as if it were previously a residential occupancy. In this case, the rules that apply to residential alterations (Chapter 7, Part 7.5) are applied.

Example 1-11: Mixed Occupancy

A 10,000 ft^2, 16 unit motel is constructed with an attached 950 ft^2 manager's residence. The manager's unit is less than 10 percent of the total floor area, so compliance of the whole building as the *predominant* motel occupancy satisfies the requirements of the standards (see Chapter 8, Part 8.2). The entire building may comply with the Nonresidential (High-Rise Residential and Hotel/Motel) Standards; or the manager's residence must comply with the low-rise Residential Standards *and* the motel occupancy portion of the building must comply with the Nonresidential Standards.

Example 1-12: Multiple Orientations

A subdivision of detached homes includes several unit types, each of which may be constructed in any orientation. The low-rise Residential Standards are applied to each building type. All four cardinal orientations may be shown to comply or each individual unit in its planned orientation must comply (see Chapter 8, Part 8.4).

Example 1-13: Apartment Building

A four-story apartment building has three stories of apartments and a garage on the first floor. For standards compliance, the low-rise Residential Standards apply since the building has fewer than four *habitable* stories. NOTE: The UBC considers this a four-story building. As a high-rise building for compliance with other building codes, different health and safety regulations apply.

1.6 WHERE TO GET HELP

If the information contained in the standards or this manual is not sufficient to answer a specific question concerning compliance or enforcement technical assistance is available from the Energy Commission's Energy Hotline, weekdays from 8 a.m. - noon and 1 p.m. - 4 p.m.:

(800) 772-3300
(916) 654-5106

Publications

Publications may be ordered from:

Publications Unit
California Energy Commission
1516 Ninth Street, MS-13
Sacramento, CA 95814
(916) 654-5200 (no phone orders)

Appendix F contains a list of available publications.

Forms and pages of publications can be faxed by an automated system at any time. This system is available by calling (916) 653-6830. You must enter a document number (a list of documents and document numbers is available on the system) and your fax number.
Some publications are accessible on the Energy Commission's Web Site www.energy.ca.gov/efficiency.

Appliance Certification Information

The Gas Appliance Manufacturers Association (GAMA) *Consumers' Directory of Certified Efficiency Ratings for Residential Heating and Water Heating Equipment* directory can be used to verify certification on *some* residential appliances. The GAMA directory (Sections I and II) can be used for gas furnaces, boilers and water heaters. Specifically *excluded* from this agreement are Gas Vented Direct Heating Equipment and Combination Water Heaters/ Space Heaters (Section II).

The Air Conditioning and Refrigeration Institute (ARI) Directory of Certified Unitary Products and Directory of Certified Applied Air-Conditioning Products can be used to verify certification of air-conditioning equipment.

The Appliance Efficiency Regulations require that a split system efficiency be based on the condenser/coil combination with the highest sales volume. ARI will prominently display in their directory a statement such as "In determining the efficiency of split systems, use the listed efficiency of the highest sales volume tested condenser/coil combinations indicated in the listings."

The Energy Hotline (see above) can verify certification of appliances not found in the above directories.

The Energy Commission's Web Site now includes listings of the most energy efficient appliances for several appliance types. The web site address is www.energy.ca.gov/efficiency/appliances/.

The complete appliance databases can be downloaded from the Energy Commission's internet FTP site (ftp://sna.com/pub/users/eff-tech/appliances). This requires database software (spreadsheet programs cannot handle some of the larger files). To use the data, a user must download the database file (or files), download a brand file and a manufacturer file and then decompress these files. Then download a description file that provides details on what is contained in each of the data fields. With these files, and using database software, the data can be sorted and manipulated.

Insulation Certification

Manufacturers whose insulating materials are certified for sale in California are listed in the Department of Consumer Affair's *Consumer Guide and Directory of Certified Insulation Material*. Each building department receives a copy of this directory. If an insulating product is not listed in the directory, or to purchase a directory, contact the Department of Consumer Affairs, Thermal Insulation Program, at (916) 574-2065.

Training Opportunities

If you are interested in attending a training seminar on the Residential Standards:

- Sign up to receive a free subscription to the *Blueprint*, a quarterly newsletter that answers questions on the standards not covered elsewhere, updated information on technical assistance and computer compliance programs, and lists training opportunities offered throughout the state. An order form is provided at the front of this *Manual*.
- Some colleges provide classes on building energy conservation and the energy

standards. Information about these classes should be obtained directly from the college.

- Energy consulting firms, organizations of energy consultants, building industry and trade associations, and organizations that serve building officials will often sponsor or conduct classes on compliance and enforcement of the Title 24 building energy efficiency standards. These classes are often listed in the *Blueprint* or posted on the Commission's website at http://www.energy.ca.gov/efficiency.

- Program vendors conduct seminars on the use of approved point system programs and approved computer methods. To contact program vendors for further information, refer to Appendix F or call the Energy Hotline for a listing of vendors who offer classes.